J. New York Entomol. Soc. 95(1):91–98, 1987

STOBAERA CONCINNA (HOMOPTERA: DELPHACIDAE): FIELD BIOLOGY, LABORATORY REARING AND DESCRIPTIONS OF IMMATURE STAGES[1]

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Abstract.—The biology of *Stobaera concinna* (Stål) was studied in south Florida from 1 June 1985 to 1 February 1986; it was reared in the laboratory and the immature stages described. *Stobaera concinna* feeds and reproduces on *Ambrosia artemisiifolia* L. and is polyvoltine. Field collected adults were returned to the laboratory and allowed to lay eggs on potted *A. artemisiifolia*. Upon emergence nymphs were separated and reared to adults. Durations of the five nymphal stadia were 4.57, 3.72, 4.00, 4.45, and 6.50 days, respectively. Nymphal instars differed in body size, number of pitlike sensoria, development of wingpads, number of metatibial and metatarsal spines, and shape and dentition of the metatibial spur.

Little is known about the biology of the 11 species of *Stobaera*. In his revision of the genus, Kramer (1973) included distributional and host plant data and noted that adults and nymphs were collected primarily from Ambrosia spp. (ragweeds); their possible role in the biological control of these noxious weeds has not been investigated. In studies of the insect fauna of 8 species of ragweeds, Goeden and Ricker (1974a, b, 1975, 1976a, b, c) provided host plant records for several species of *Stobaera*. Reimer and Goeden (1981, 1982) described the immature stages of *Stobaera tricarinata* (Say), the most widely encountered species, and outlined the life history on its host, western ragweed (*Ambrosia psilostachya* DeCandolle).

Stobaera concinna (Stål) has been reported from most of southern North America, including Arizona, California, Colorado, Florida, Louisiana, Texas, Utah, and Mexico as well as the West Indies (Kramer, 1973). It has been recorded from *A. concertiflora* DeCandolle and *A. psilostachya* DeCandolle (Kramer, 1973; Goeden and Ricker, 1975, 1976c). Kramer (1973) suggested that *A. concertiflora* is the principal host with *A. psilostachya* serving as an alternate host or food plant. Neither of these ragweeds occurs in south Florida; however, *S. concinna* is present and abundant on *A. artemisiifolia* L.

The present study summarizes the biology of *S. concinna* and its relationship with *A. artemisiifolia* L. in south Florida, and includes information on laboratory rearing, descriptions and illustrations of immature stages and a key to nymphal instars.

[1] Florida Agricultural Experiment Station Journal Series No. 7090.

MATERIALS AND METHODS

Field and laboratory studies. Field and laboratory studies were conducted at the Ft. Lauderdale Research and Education Center, Ft. Lauderdale, Florida. Sweep net samples (100 sweeps/week) were taken weekly in a pure stand of *Ambrosia artemisiifolia* L., ca. 20 × 30 m, from 1 June to 10 September 1985. After 10 September, weekly observations of *S. concinna* on individual plants continued through 1 February 1986. The information recorded included the number of adults and immatures collected, feeding sites, and oviposition sites. Adults were returned to the laboratory and placed on *A. artemisiifolia* plants grown in 15.2 cm diam. pots at 26.7°C and 12L:12D photoperiod and allowed to lay eggs. Cylindrical butyrate cages (Tsai, 1975) were used to keep insects on the host plants. Upon hatching the immatures were removed from the plant and placed in 2.5 cm diam. culture tubes containing a fresh *A. artemisiifolia* leaf and stem. The culture tube opening was covered with Parafilm® to prevent escape and desiccation. Plant tissue was replaced every 3 days or when required. Dead insects were replaced to obtain adequate numbers completing each molt. Daily observations of nymphs were made and dates of molts recorded.

Descriptions of immatures. The descriptions and illustrations of the egg and each nymphal instar and a key to nymphal instars are based upon laboratory reared individuals.

The 5th instar is described in detail but only major differences are described for 4th through 1st instars. Measurements are given in mm as mean ± SD. Length was measured from apex of vertex to apex of abdomen, width across the widest part of the body, and thoracic length along the midline from the anterior margin of the pronotum to the posterior margin of the metanotum. Eggs were obtained by removing them from host plants by inserting a needle under each egg and teasing it free.

RESULTS AND DISCUSSION

Field study. Six hundred and seventy-three adults were collected throughout the study, and consisted of 72% of all *S. concinna* collected. Immatures were found from 13 June to 25 July and again from 9 August to 1 February 1986. *S. concinna* is polyvoltine with eggs laid continuously throughout the study. First and 5th instar nymphs were collected simultaneously due to the overlapping of generations.

As ragweeds began dying in early September, *S. concinna* numbers decreased slightly. However, as ragweed seedlings began appearing *S. concinna* numbers began to increase.

Adults and 4th and 5th nymphal instars were observed feeding on small to medium sized stems. First, 2nd, and 3rd nymphal instars fed on small leaf veins or midribs on the underside of leaves. Reimer and Goeden (1982) found similar feeding habits in *S. tricarinata* with 1st and 2nd instars feeding on the under surface of leaves on small veins and 3rd, 4th, and 5th instars feeding on stems.

Eggs were inserted singly in transverse rows of 3 to 5 eggs in small stems. Upon emergence, nymphs would walk to the nearest leaf to begin feeding.

Laboratory study. The duration of nymphal development was ($\bar{x}$ ± SD) 23.4 ± 2.16 days. High mortality (75%) of 4th and 5th instar nymphs occurred early in the study but decreased when nymphs were provided with larger sections of ragweed

Table 1. Duration (in days) of the nymphal instars of *S. concinna.*

Nymphal instar	No. beginning	No. completing	Days	
			Range	Mean ± SD
1st	23	21	3–7	4.57 ± 1.03
2nd	29	25	3–5	3.72 ± 0.68
3rd	29	20	3–7	4.00 ± 1.17
4th	38	26	3–6	4.45 ± 1.05
5th	35	20	5–9	6.50 ± 1.28

stems and when stems were changed daily. Duration of the nymphal stadia are given in Table 1.

Descriptions of Nymphal Instars

Fifth instar (Fig. 1). Length 2.16 ± 0.267; thoracic length 0.79 ± 0.089; width 1.11 ± 0.137. N = 20.

Form elongate, subcylindrical, slightly flattened dorsoventrally, widest across mesothoracic wingpads. Body mottled dark brown and cream, legs pale with dark brown transverse bands.

Vertex quadrate, length ca. 0.75× width at base, posterior margin almost straight; carina on each side extending anteromedially from posterolateral corner and continuing onto frons as inner carina. Frons subrectangular; widest in upper ⅓, width ca. 0.8× length; carinate lateral margins convex, these outer carinae extending from vertex to near clypeal border and paralleled by pair of inner carinae; 9 pits between each inner and outer carina and 4 pits between each outer carina and eye. Gena with longitudinal row of 3 small pits. Clypeus narrowing distally, consisting of subconical basal postclypeus and cylindrical distal anteclypeus. Beak 3-segmented, segment 1 obscured by anteclypeus, lengths of segments 2 and 3 subequal; apex of segment 3 black. Eyes reddish. Antennae 3-segmented; scape slightly flattened anteroventrally; pedicel subcylindrical, ca. 2× length of scape, with ca. 12–14 pitlike sensoria; flagellum bulbous basally, with elongate, bristle-like extension distally, bulbous base ca. 0.2× length of pedicel.

Thoracic nota divided by middorsal line into three pairs of plates. Pronotal plates subrectangular, appearing triangular in dorsal view; anterior margin following posterior border of eye, posterior border sinuate; each plate with oblique posterolaterally directed carina originating on anterior margin in median ⅓ and terminating in middle of plate, carina bordered along inner margin by row of 7 pits extending posterolaterally to lateral border of plate (lateralmost pits not visible in dorsal view). Mesonotal median length ca. 1.5–2× that of pronotum; subrectangular; each plate bearing an elongate lobate wingpad extending to, or nearly to, tip of metanotal wingpad; with posterolaterally directed carina originating on anterior margin in median ¼ and terminating on posterior margin; 2 pits on either side of carina and 3 pits in lateral ⅓. Metanotal median length ca. 0.75× that of mesonotum; each plate bearing an elongate lobate wingpad extending to 4th tergite; with longitudinal carina originating

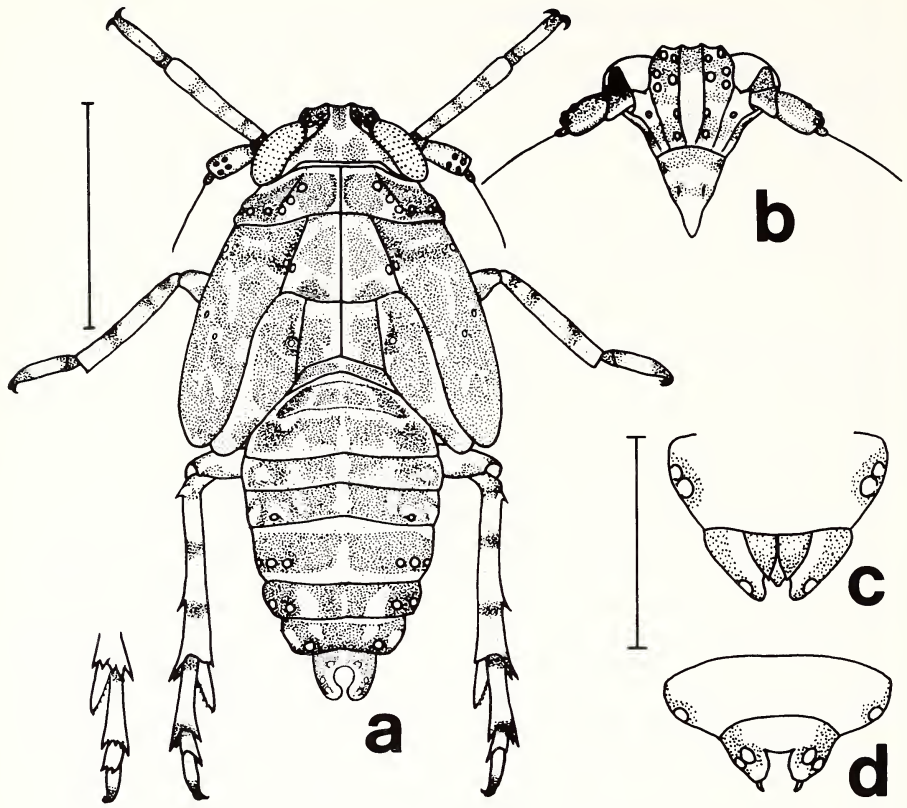

Fig. 1. *S. concinna* fifth instar. A. Habitus. B. Frontal view of head. C. Apical part of venter of female abdomen. D. Apical part of venter of male abdomen. Vertical bar = 1.0 mm.

on anterior margin in median ¼ and terminating on posterior margin; 1 pit just lateral to carina. Pro- and mesocoxae elongate, posteromedially directed; metacoxae fused to sternum. Metatrochanter subcylindrical, with row of 15 minute teeth on posteromedial aspect. Metatibia with 2 black-tipped spines on lateral aspect of shaft, an apical transverse row of 5 black-tipped spines on plantar surface and a subtriangular, flattened movable spur with a row of 5–7 teeth on lateral aspect. Pro- and mesotarsi with 2 tarsomeres; tarsomere 1 wedge-shaped; tarsomere 2 subconical, curved, and with pair of apical claws and median membranous pulvillus. Metatarsi with 3 tarsomeres; tarsomere 1 cylindrical with apical transverse row of 6 black-tipped spines on plantar surface; tarsomere 2 cylindrical, with apical transverse row of 3 black-tipped spines on plantar surface; tarsomere 3 subconical similar to terminal tarsomere of other legs.

Abdomen 9-segmented; slightly flattened dorsoventrally, widest across segment 4 or 5. Tergite 1 reduced, tergites 5–8 each with 3 pits on either side of midline

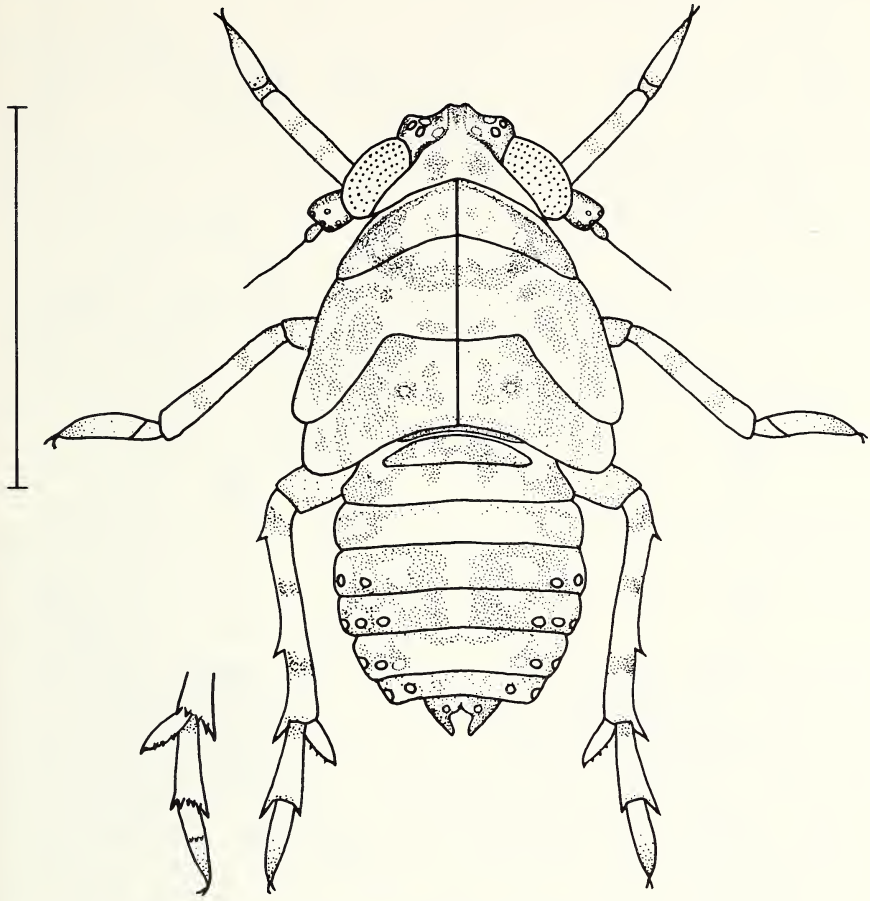

Fig. 2. *S. concinna* fourth instar. Vertical bar = 1.0 mm.

(lateralmost pits not always visible in dorsal view due to curving of tergites onto ventral aspect). Segment 9 surrounding anus; with 3 pits on each side; female with 1 pair of acute processes extending caudally from juncture of sternites 8 and 9; males lacking processes.

Fourth instar (Fig. 2). Length 1.83 ± 0.195; thoracic length 0.67 ± 0.083; width 0.87 ± 0.120. N = 17.

Frons with fewer pits between each outer carina and eye. Antennal pedicel with 6–8 sensoria.

Mesonotal wingpad ⅔ length of metanotal wingpad. Metanotal wingpad extending to 3rd tergite. Metatibial spur slightly smaller with row of 4 teeth on lateral aspect. Metatarsi with 2 tarsomeres; tarsomere 2 subconical with 3 black-tipped spines in median portion of tarsomere on plantar surface.

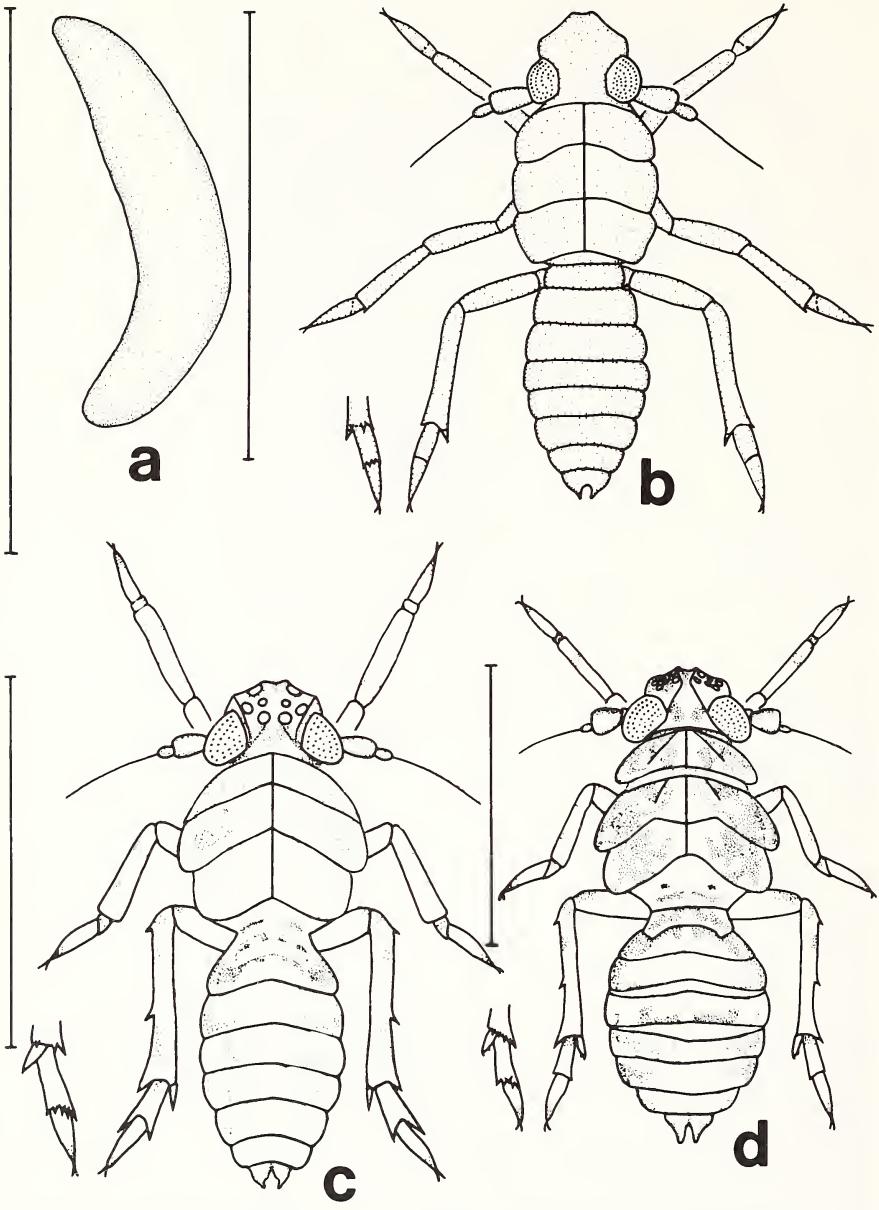

Fig. 3. *S. concinna* immature stages. A. Egg. B. First instar. C. Second instar. D. Third instar. Vertical bar = 1.0 mm.

Third instar (Fig. 3d). Length 1.62 ± 0.082; thoracic length 0.55 ± 0.035; width 0.70 ± 0.056. N = 12.

Antennal pedicel with 4–6 sensoria; bulbous base of flagellum ca. ½× length of pedicel.

Mesonotal wingpad shorter, covering ⅓ of metanotal wingpad laterally. Metatibial spur smaller; 2 teeth on margin. Metatarsomere 1 with apical transverse row of 5 black-tipped spines on plantar surface; tarsomere 2 without spines in middle.

Second instar (Fig. 3c). Length 1.38 ± 0.062, thoracic length 0.45 ± 0.022; width 0.45 ± 0.048. N = 15.

Antennal pedicel with 2 sensoria. Meso- and metanotal wingpads undeveloped. Metatibia with apical transverse row of 4 black-tipped spines on plantar surface; spur smaller lacking lateral teeth, with black tipped tooth at apex.

Abdominal tergites with pits very obscure, tergite 5 with fewer pits and 6–8 each with 3 pits on either side of midline (lateralmost pits not visible in dorsal view due to curving of tergites onto ventral aspect).

First instar (Fig. 3b). Length 0.97 ± 0.115; thoracic length 0.34 ± 0.055; width 0.29 ± 0.026. N = 20.

Mottling absent or nearly so, body cream colored. Antennal pedicel lacking sensoria. Metatibia lacking spines on shaft; spur greatly reduced, slightly longer than longest metatibial spine, with black-tipped tooth at apex.

Egg (Fig. 3a). Length 0.82 ± 0.015, width 0.15 ± 0.017. N = 7. Eggs laid singly; white; cylindrical; chorion translucent, smooth.

Reimer and Goeden (1981) noted that first instar *S. tricarinata* lacked a metatibial spur, this is present in all other first instar delphacids examined (for example *Stenocranus lautus* Van Duzee, *Megamelus davisi* Van Duzee, *Pissonotus delicatus* Van Duzee, *Delphacodes idonea* Beamer, and *D. bellicosa* Muir and Giffard) (Calvert, Tsai, and Wilson, unpubl. data; Calvert and Wilson, 1986; Wilson, 1985; Wilson and McPherson, 1981); however, as the spur is very small it is difficult to find. They also reported a different arrangment of the 9 pits on the frons of the 5th instar; the arrangement found for *S. concinna* is similar to that reported for European delphacids by Vibaste (1968).

Key to S. concinna *Nymphal Instars*

1. Metatibial spur with marginal teeth; more than 3 pit-like sensoria present on antennal pedicel (Figs. 1, 2, 3D) 2
– Metatibial spur without marginal teeth; antennal pedicel with 2 or fewer pit-like sensoria (Fig. 3B, C) 4
2. Metatarsi with 3 tarsomeres; mesonotal wingpads extending to or almost to apex of metanotal wingpads (Fig. 1) ..... 5th instar
– Metatarsi with 2 tarsomeres (tarsomere 2 may be partially subdivided); mesonotal wingpads not extending to apex of metanotal wingpads (Figs. 2, 3D) 3
3. Metatarsomere 2 with 3 small spines in middle; mesonotal wingpads covering ca. ⅔ of metanotal wingpads (Fig. 2) ..... 4th instar
– Metatarsomere 2 without spines; mesonotal wingpads covering less than ⅔ of metanotal wingpads (Fig. 3D) ..... 3rd instar
4. Metatibia with 2 spines on shaft; antennal pedicel with 2 pit-like sensoria (Fig. 3C) ... . 2nd instar

– Metatibia apparently lacking spines on shaft; antennal pedicel lacking pit-like sensoria (Fig. 3B) ..... 1st instar

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Received February 5, 1986; accepted March 5, 1986.